



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

in Excuse of this Trouble, farther than that I have
the Honour to be with great Respect,

S I R,

*London, Jan. 14.
1746-7.*

*Your most obliged,
and humble Servant,*

Richard Brocklesby.

**XIII. A Letter from Mr. Richard Dunthorne,
to the Rev. Mr. Cha. Mason, F. R. S. and
Woodwardian Professor of Nat. Hist. at
Cambridge, concerning the Moon's Motion.**

S I R, Cambridge, Nov. 4. 1746.

Read Feb. 5. 1746-7. **I**N the Preface to my lunar Tables, I hinted, that one Use of publishing those Tables would be, the assisting of Persons desirous farther to rectify the lunar Astronomy, by enabling them more readily to compare the *Newtonian Theory* with Observations.

Since the Publishing those Tables, I have spent some Time myself in that Comparison; and here send you the Result, that you may communicate it to the *Royal Society*, if you think it deserves to be made public.

As the Motion of every secondary Planet must partake of the Errors in the Theory of its primary, I thought proper, before I undertook the Examination of the lunar Numbers, to compare those of the Sun with Observations. I compared several Sets of

Mr.

Mr. Flamsteed's Observations, after the Method he himself teaches, in *Prolegom. Hist. Cælest.*, p. 133, & seq. which, for many Reasons, I think the best Method hitherto used; and, with the Concurrence of a Gentleman well skilled in these Matters, determined the mean Motion of the Sun at Greenwich, the last Day of December at Noon, Anno 1700, O. S. $\varpi 20^{\circ} 43' 40''$ of its Apogee, $\Phi 7^{\circ} 30' 0''$, and the greatest Equation of the Sun's Centre $1^{\circ} 55' 40''$; which, I am fully persuaded, are very near the Truth.

The Theory of the Sun being thus settled, I proceeded to examine the Elements of the lunar Astronomy. I began with Observations of lunar Eclipses about the Equinoxes, when the Apogee of the Moon was in the Sun's Quadratures; because at those Times I could conceive the Moon's Motion affected with no Inequality, but the annual one, called by Newton the first Equation, and the elliptic one, called *Prostaphæresis*: From a Comparison of such Observations I obtained the Moon's mean Longitude, which came out $1'$, at least, greater than in the Tables, and very nearly as Newton has it in the last Edition of his *Principia*.

I went on to examine the Place and Motion of the Apogee, and Theory of the Increase and Decrease of the Eccentricity, as well as the greatest and least Eccentricities themselves (from the best Observations, and best situate that I could procure) all which agreed so well with the Tables, about the Sun's mean Distances, that I dare venture to make no Alteration therein: Indeed I think the 6th Equation does not so well account for the Variation of the Motion of the Apogee, and Change of the Eccentricity,

tricity, according to the greater or lesser Distance of the Sun from the Earth; and therefore I set myself to compute what Change this Difference of the Sun's Action upon the lunar Orbit would introduce in the Moon's Place in every Situation of the Sun and lunlar Orbit; and found, after many tedious Computations, that the Sun being in Apogee, this Change, where greatest, would amount to about $4'$, and to $4' 16''$, when the Sun is in Perigee. In other Distances of the Sun from the Earth, this greatest Change is proportional to the Difference of the Cubes of the mean and present Distances; and in every Situation of the Moon, and of her Orbit, the present is to the greatest Equation nearly as the Sine of the Excess of the Moon's mean Anomaliy above twice the annual Argument to *Radius*. It increases the Moon's Longitude, when the Sun is in his $\{$ *Apogeon* $\}$ Semicircle, and that Excess $\{$ lets $\}$ than 180° ; and diminishes it when otherwise \ast .

In fine, I compared the Theory of the Moon, as to her Longitude, with several Observations, as well in the Octants and Semi-Octants, as in the Syzygies and Quadratures, and found such an Agreement when the above Corrections were made, as seemed rather to be wished than hoped for, considering the many Inequalities wherewith the Sun's Action disturbs the Motion

\ast If this Equation be increased and diminished in a direct *Ratio* of the Moon's horizontal Parallax, it will become more exact. And I think, if it were always diminished by a fourth or perhaps a third Part, it would agree better with Observations.

Motion of the Moon, and the Defects to which the best Observations I have hitherto met withal are liable.

I have compared 100 observed Longitudes of the Moon with the Tables; viz. 25 Eclipses of the Moon, all, except the first, taken from Flamstead's *Historia Cœlestis*, the *Philosophical Transactions*, and the *Memoirs of the Royal Academy of Sciences*; the two great Eclipses of the Sun in 1706 and 1715; 25 select Places of the Moon from Flamstead's *Historia Cœlestis*, and 48 of those Longitudes of the Moon computed from Flamstead's Observations by Dr. Halley (as I suppose) printed in the first Edition of the *Historia Cœlestis*. They are as follows:

25 Eclipses of the Moon, and 2 of the Sun, compared with the Tables corrected as above.

Place of Observation.	A.D.	Apparent Time at Greenwich.	D'struct. Place Observed.	M. An.			Ann.	D's Place comp'd.	Date of Observat.			
				h	m	s	o	/	s	o	/	
Danzick	1652	Septem. 7. 6 21 35	11 25 51	2	20	6	2	0	3	1 25	26 10	
Danzick	1670	Sept. 18. 14 36 48	0 6 13 29	3	1	6	0	0 $\frac{1}{2}$	0	6 16	21	
Danzick	1678	Octob. 19. 8 21 54	1 6 47	9	4	1	7	16 $\frac{1}{2}$	2	1 6 46	35	
Greenwich	1682	Sept. 14. 10 58 52	5 3 47	3	25	6	28 $\frac{1}{2}$	1	14	5 3 46	15	
Paris	1684	Dec. 11. 10 47 6	3 1 11 20	5	24	1	8	7 16	2	1 13	-	
Danzick	1685	Nov. 30. 10 35 39	2 19 40	0	5	13	11 26 $\frac{1}{2}$	5 25	2	19 39 45	-	
Dublin	1686	Nov. 19. 11 53 11	2 8 11 57	5	20	10 12 $\frac{1}{2}$	4	4 $\frac{1}{2}$	2	8 11 28	-	
Greenwich	1689	Sept. 18. 14 32 37	0 6 32	8	3	1	4	24	0	6 3 16	1	
Paris	1690	March 14. 9 56 36	6 4 37	11	8	25	9 18	3 15 $\frac{1}{2}$	6	4 37 28	1	
Paris	1696	May 6. 12 2 0	7 26 53	14	10	18	3 1 $\frac{1}{2}$	8 28	7	26 53 45	1	
Paris	1699	March 5. 7 13 44	5 25 32	27	8	16	8 27	3 1	5 25	32 14	1	
New England	1703	Decem. 11. 13 29 8	3 0 49 56	5	23	11 24 $\frac{1}{2}$	5 23	3 0 48	51	-	1 5	
Malteilles	1706	May 21. 13 57	1 20 46	44	10	12	6 22	7 6	1 29 46	35	0 12	
Greenwich	1707	Octob. 10. 7 13 0	0 23 0	20	3	22	5 27	11 25	2 27 58 45	-	1 33	
Paris	1708	Sept. 18. 9 10 25	0 6 39 23	2	1	2 12	8 7	0	6 39 11	-	0 13	
Paris	1712	J.n. 12. 7 34 0	4 2 57	47	6	24	1 17 $\frac{1}{2}$	7 25 $\frac{1}{2}$	4	2 58 31	-	0 50
Paris	1713	Nov. 20. 15 27 30	2 9 58	21	5	3	9 21	3 17	2 9 56 56	-	1 25	
London	1715	April 21. 21 11 5	1 12 0	22	10	3	6 12 $\frac{1}{2}$	6 22	1 11 59 36	-	0 46	
Paris	1717	March 15. 15 7 4	6 6 23	50	8	26	8 2 $\frac{1}{2}$	2 27	6 6 23 31	-	0 19	
Paris	1719	August 18. 8 22 46	11 5 42	8	1	29	10 23	4 20	11 5 42 35	-	0 4	
Paris	1722	June 17. 13 46 10	9 6 47	43	11	29	5 8 $\frac{1}{2}$	10 25	9 6 47 33	-	0 31	
Paris	1724	Octob. 20. 15 40 40	1 9 0	0	4	2	5 25 $\frac{1}{2}$	11 22	1 8 58 50	-	0 10	
Paris	1729	Febr. 28. 13 0 0	4 25 13 39	7	16	3 25	9 14	4 25 14 40	-	1 1		
Paris	1731	June 8. 13 47 51	8 28 9 58	11	19	4 27	10 11	8 28 9 45	-	1 13		
Paris	1732	Nov. 20. 0 49 25	2 10 3 54	5	3	7	8	1 24	2 10 0 56	-	2 58	

25 Places of the Moon, computed by myself from Flamsteed's Observations, compared with the Tables.

[417]

A.D.	Apparent Time at Greenwich.	D's true Place observed.			M. Anom. D.			Ann. Arg.			D's Place computed.			Diff. from Obsrvar.				
		h	m	s	o	/	s	o	/	s	o	/	s	o	/	s	o	/
1684	March 13.	8	9	8	2	28	48	40	8	25	2	25	11	19	2	28	50	44
1693	March 6.	7	22	46	3	16	43	12	8	17	3	11	11	7	3	16	44	0
	Octob. 11.	18	12	34	3	28	34	2	3	24	2	27	5	15	3	28	38	21
1694	Febr. 27.	10	29	16	4	27	27	31	8	10	3	12	9	20	4	27	26	48
	August 23	11	13	54	11	0	19	11	2	5	8	2	21	11	0	21	41	+
1694	Septem. 15.	5	34	13	8	27	1	34	2	27	6	10	3	11	8	27	1	44
	Septem. 21.	10	59	31	11	22	47	41	3	3	9	3	17	11	22	49	16	+
1695	Decem. 13.	6	2	53	0	6	28	43	5	25	8	26	2	6	0	6	29	58
	Febr. 8.	3	55	22	1	5	14	3	7	21	9	7	22	1	5	12	14	+
July	9.	5	56	14	7	2	2	42	0	20	3	14	0	2	7	2	3	4
	Septem. 8.	8	30	26	10	3	0	12	2	20	5	21	1	24	0	2	59	55
1696	January 16.	17	29	2	7	5	4	20	6	29	2	29	5	2	7	5	6	11
	March 4.	9	8	13	4	12	2	24	8	16	11	8	7	3	4	12	0	59
1697	February 18.	6	29	47	2	20	52	29	8	2	8	19	5	10	2	20	51	7
	19.	7	22	57	3	4	18	16	8	3	2	2	5	11	3	4	17	54
	Septem. 15.	7	54	41	10	1	7	8	2	23	3	21	11	9	10	1	5	38
1698	Septem. 8.	11	2	35	11	12	15	6	2	21	3	24	1	9	23	11	12	15
	Novem. 27.	3	49	54	10	11	33	39	5	9	2	2	0	3	10	11	31	15
1699	March 5.	12	8	23	5	28	15	59	8	16	8	29	2	1	5	28	16	11
1701	Septem. 28.	6	55	23	9	27	13	17	3	10	9	9	6	8	9	27	12	49
1702	Octob. 16.	6	15	49	10	3	25	41	3	28	8	11	2	5	15	10	3	26
																		+
1703	Septem. 13.	11	58	50	11	28	50	30	2	25	8	28	3	3	11	28	53	30
	Octob. 6.	6	28	39	9	27	1	44	3	18	7	4	3	23	9	27	0	38
1706	Octob. 10.	11	11	10	1	11	11	15	3	22	6	0	11	25	1	1	10	1
1714	Septem. 6.	6	34	7	9	3	44	13	2	18	3	17	0	0	9	3	45	24

48 Places of the Moon, computed by Dr. Halley, from Flamsteed's Observations,
compared with the Tables.

[418]

A.D.	Apparent Time at Greenwich	D's true Place observed.				M. An-				Ann. Arg.				D's Place computed				Diff. from Observat.				
		h	m	s	o	'	"	o	'	"	s	m	o	'	"	s	m	o	'	"	s	m
1689	Novem.	16.	11	59	0	2	6	12	43	4	29	6	1	0	2	6	14	4	+	1	55	
	Decem.	9.	6	1	0	11	28	43	54	5	21 $\frac{1}{2}$	3	21	0	20 $\frac{1}{2}$	11	28	48	40	-	0	14
		10.	6	46	35	0	12	46	49	5	22 $\frac{1}{2}$	4	4	0	21 $\frac{1}{2}$	0	12	47	14	+	0	25
		12.	8	26	33	1	12	13	8	5	24 $\frac{1}{2}$	5	C $\frac{1}{2}$	0	23	1	12	10	35	-	2	29
		13.	9	24	50	1	27	38	36	5	25 $\frac{1}{2}$	5	14	0	24	1	27	36	16	-	2	20
1690	January	16.	12	42	0	3	15	14	54	5	28 $\frac{1}{2}$	6	24	0	27	3	15	15	48	+	0	54
		4.	3	3	46	11	11	12	59	6	17	2	24	1	14	11	11	13	8	+	0	9
		6.	4	30	15	0	8	13	31	6	19	3	20 $\frac{1}{2}$	1	16	0	8	14	36	+	1	5
		10.	7	59	22	2	6	11	20	6	23	5	14 $\frac{1}{2}$	1	19 $\frac{1}{2}$	2	6	10	37	-	0	43
		12.	10	8	49	3	7	5	21	6	25	6	12 $\frac{1}{2}$	1	21	3	7	3	59	-	1	22
	February	13.	11	14	0	3	22	36	28	6	26	6	25 $\frac{1}{2}$	1	22	3	22	35	19	-	1	9
		2.	2	25	39	0	3	57	24	7	15 $\frac{1}{2}$	3	5	2	10	0	3	56	9	-	1	15
		5.	4	51	10	1	16	31	33	7	18 $\frac{1}{2}$	4	26	2	12 $\frac{1}{2}$	1	16	34	15	+	2	42
		7.	6	48	17	2	15	58	14	7	20 $\frac{1}{2}$	5	24	2	14 $\frac{1}{2}$	2	15	59	13	+	0	59
		8.	7	51	54	3	0	56	20	7	21 $\frac{1}{2}$	6	8	2	15 $\frac{1}{2}$	2	16	57	21	+	0	11
		10.	9	56	26	4	0	55	24	7	24	7	6	2	17	+	55	1	-	0	23	
		11.	10	52	31	4	15	42	16	7	25	7	20	2	18	4	15	41	49	-	0	27
		14.	13	19	31	5	28	12	40	7	28	9	2	2	21	5	28	11	44	-	0	56
		19.	17	3	55	8	2	23	20	8	3	11	12	2	25 $\frac{1}{2}$	8	2	21	17	-	2	9
		21.	18	45	37	8	27	1	25	8	5	0	10	2	27 $\frac{1}{2}$	8	26	59	6	-	2	19

a, The Time of the Middle of this Eclipse here set down is from the Beginning and End ; but *Hevelius* says he could not observe the Beginning exactly. Several intermediate *Phases* compared together shew the Middle to have been about 4' sooner ; to which the Moon's Place computed is os. $6^{\circ}.$ $14'.$ $3''.$ and Diff. $+ 34''.$

b, b, b, The Moon's Places, observed on *Feb. 2.* *April 7.* and *May 22.* are computed by myself, from the Observations ; there being manifestly Errors, either of the Computation or Press, in those printed in the *Hist. Cœlestis.*

Several observed Latitudes of the Moon, which I have compared with the Tables, shew them to be very near the Truth, both in the Motion of the Nodes, and also in the Quantity and Variation of the Inclination. I am,

S I R,

Your humble Servant,

Richard Dunthorne.